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Trash Cover

PREVENTS

Soil Erosion

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TRASH COVER *Prevents* SOIL EROSION

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Introduction

Concern and alarm is becoming more evident each year over the tremendous losses of precious top soil from our farm lands. Each year, wind and water erosion are damaging thousands of acres of the best agricultural soil in Western Canada.

Fertility Losses

The removal of one inch of fertile top soil by erosion means the loss of roughly 300 pounds of phosphorous and 1,500 pounds of nitrogen per acre —enough of these two elements to grow 20 fifty-bushel crops of wheat. It would cost more than $200.00 to replace this amount of plant food, through the application of commercial fertilizer. Furthermore, 15 tons of organic matter are lost with each inch of top soil removed by erosion, and organic matter is the life of the soil. Organic matter has a beneficial effect upon the micro-organisms in the soil which are responsible for changing certain soil elements into a form which plants can use. It also acts as a blotter in absorbing and holding moisture; improves the tilth or physical condition of the soil; and has a binding effect upon the soil particles. It is no exaggeration to say that the future of agriculture on many of our soils depends largely upon how well organic matter can be maintained or increased.

Yield Losses

Experiments conducted by the Dominion Experimental Farms show clearly that lost top soil results in lowered yields. In one experiment various depths of top soil were removed from a field which was then seeded to barley. The resulting barley yields per acre were as follows:

No top soil removed	3 inches removed	6 inches removed	All top soil removed
39.5 bus.	32.7 bus.	18.0 bus.	4.2 bus.

These yield results present clear-cut evidence of the vital necessity of protecting the top soil on our prairie farms.

Better Soil—Better Health

The health of a nation depends upon the soil. This fact was demonstrated in the United States during the last war. All young men drafted to the armed services were required to go before a Medical Board. Of the men from the eroded Piedmont Plain of southeastern United States only a low percentage passed the medical test, while a much higher percentage of those drafted from the rich soil areas of the Midwest passed the same test.

To be healthy, people require good food. Good food comes from healthy plants. Healthy, nutritious plants do not grow on poor eroded soil.

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Importance of Trash Cover

The main object of this leaflet is to draw attention to the value of trash cover in preventing both wind and water erosion of soils in Western Canada. Trash cover is recommended for five very sound reasons:

1. It is effective.
2. It involves no additional cost to the farmer.
3. It requires no major change in the existing farm program.
4. It returns a considerable amount of plant food to the soil.
5. It helps maintain essential organic matter.

It is realized of course that a trash cover alone will not solve the problem of water erosion control associated with steep slopes. A well-prepared trash cover will, however, satisfactorily control water erosion on a very large percentage of the cultivated area in Western Canada.

Causes of Soil Erosion

When the white man first settled the Western Plains the soil was covered with grass or forest. The water in the streams was clear, indicating that little erosion was taking place. As settlement increased, more and more sod was broken and large forested areas were cleared by axe and fire to yield more land for the production of food. Before long, as a result of unwise land-use practices, dust storms, gullied fields and muddy, silted streams revealed the loss of precious top soil by wind and water erosion. In time, dust storms became more frequent and more severe, until in the 1930's the Prairie Provinces were faced with a major soil drifting calamity. Rills and gullies too became increasingly common in cultivated fields, proving that water erosion was developing into a major problem. In plain words, the removal of the native grass and forest cover, together with the destruction of the fibre and organic matter in the soil through repeated and improper cultivation brought about dangerous soil erosion.

Soil Drifting

As early as 1920 soil drifting was a serious problem in the southwest portion of Alberta and long before the occurrence of the "dust bowl" conditions of the "Thirties," farmers in the Monarch-Nobleford areas were using effective means of soil drifting (erosion) control. By tilling their fields in narrow strips and by utilizing every scrap of stubble and weed growth to form a trash cover, they were able to protect their fields from erosion.

Strip Farming

Several years ago, an observant farmer in southwestern Alberta noticed that soil drifting was less serious at the windward edge of his fallow field and became more severe as it advanced across the bare soil. He decided to have more windward edges and devised a plan of farming his land in strips. Before long, most of his neighbors were practising "strip farming."

The manner in which strip farming acts to reduce soil erosion may be described briefly as follows. Soil drifting, as every farmer knows, spreads rapidly on a bare field due to the scouring action of wind-borne soil particles. Soil particles are picked up by the wind, carried for some

distance, and then fall. When they strike bare soil they loosen several other particles of soil. These in turn are carried by the wind, strike more soil particles which are in turn broken loose, thus increasing the scouring action. Where a field is farmed in alternate strips of crop and fallow, the cropped strips filter out the soil particles from the wind. In this way the scouring action, if not entirely eliminated, is very greatly reduced. Alternate cropped strips have proved to be very effective in preventing wind erosion over large areas of cultivated land.

The Trash Cover

Trash cover is an effective method of controlling erosion because all stubble, straw and weed growth present is used to produce a protective surface cover for the soil. Experience has shown that to make the best use of trash the plow had to be discarded, and surface-tillage machines substituted. The blade machines, the duckfoot cultivator, the rod weeder, the one-way disc and the recently introduced discer are now the recommended implements for the cultivation of soils that are subject to erosion.

In dry years, when crop growth is sparse, the problem of maintaining a protective cover on fallow fields is difficult. Extreme care must be exercised in the operation of tillage implements to preserve all available stubble and weed growth as a trash cover. Slowing down the speed at which implements are operated is essential. High speeds either bury the trash, or throw it out on the surface where it may be easily blown away. In addition, high speeds are very destructive of soil fibre and soil structure. The ideal trash cover has straw, stubble and weed growth firmly anchored in the surface soil. (Cultivation need only be deep enough to make a "clean cut" at each operation in order to destroy weed growth).

In areas of higher precipitation, however, where there is likely to be a greater amount of trash present, the production of a satisfactory trash cover calls for different methods. Here the problem is not one of conserving a limited amount of trash to secure the maximum amount of cover, but primarily one of coping with a large amount of crop residue. Where a field has been harvested with a binder there is rarely any difficulty in handling the stubble effectively. On the other hand, where a heavy crop of straw has been returned to the field through the use of the combine, considerable difficulty may be encountered in getting this crop residue properly worked into the soil.

Straw Spreader Important. The efficiency of the straw spreader on the combine will, to a considerable extent, determine the ease or difficulty with which trash can be handled. If the straw has been spread uniformly, little difficulty should be encountered; whereas if it has been left in bunches or windrows, trouble is almost bound to occur. Dry straw, which has been spread evenly, is not difficult to work with the one-way, the discer or the three-row cultivator. Wet straw, on the other hand, is difficult to work with rolling disc machines, and will "plug" a cultivator very readily.

Straw Cutters. During the past few years various types of "straw cutters", for attaching to the combine, have appeared on the market. Some are of simple construction, quite effective, and require little power to operate. Others are complicated and require so much power to operate that they affect the threshing efficiency of the combine. The efficiency of a straw cutter should be determined not by its ability to cut the straw

into very short lengths, but rather by its ability to spread the straw uniformly behind the combine. Where crops are heavy, and trouble encountered in handling the resulting trash, an efficient straw cutter is well worth considering.

Choice of Implement. Choice of implement is extremely important in the handling of a trash cover. The one-way disc, if operated at low speeds, is usually quite satisfactory for the first operation. However, where there is only a small amount of trash present, a better practice is to use a duckfoot or blade machine. These implements, if properly used, will make the best possible use of the limited amount of material present and produce an efficient soil cover.

Seeding Trash-Covered Land

In many cases it may not be necessary to cultivate trash-covered land prior to seeding. Such land is usually seeded with a tiller-combine or discer with seeder box attachment. In certain cases, however, it may be necessary to cultivate at least once before seeding.

With heavy crop residue the most satisfactory machine for pre-seeding tillage is, in most areas, the one-way or discer. Blade machines are excellent in areas where soil and moisture conditions permit their use.

While low speeds and shallow cultivation are recommended at all times, they are particularly important where the field is to be seeded almost immediately after being tilled. Slow, shallow cultivation will keep the stubble anchored in the surface soil, and leave most of the straw on the surface. High speeds and deep cultivation mix a great deal of the crop residue into the soil, and often leaves a loose, dry layer of soil at seeding depth. Seed placed in this dry mixture of soil and straw is in direct competition for moisture and plant food with the soil organisms responsible for decomposing the trash. Such competition is likely to result in lowered yields.

If the first cultivation is carried out as described above there should not be too much difficulty in planting the field with a seed drill. If the trash is extremely heavy, however, and difficulty is encountered in obtaining proper penetration with the seed drill, the logical alternative is to seed with a one-way or discer equipped with a seeder box.

Handling Trash on Fallow Land

Some farmers, even in areas where large quantities of trash are present, find it difficult to preserve adequate trash cover throughout the fallow year. The reasons for this are quite obvious—too high speeds and too deep cultivation. This is particularly true where the one-way is used almost exclusively in the fallow operations. The speed of travel with the one-way or discer should not exceed 4 miles per hour; 3½ m.p.h. is a better speed. Using the duckfoot cultivator, blade machine or rod weeder in place of a disc machine, for at least some of the fallow operations, will also help conserve valuable soil cover.

Emergency Methods in Soil Drifting Control

Even on farms where soil drifting control measures are constantly practised some drifting may occur. In cases of this kind it is obvious that some type of emergency control measures will be required. Three such methods, both practical and effective, are described as follows.

Spreading Straw. Soil drifting usually starts on a small area and then spreads. The starting or focal point may be a bare knoll, a small area of light soil, or a portion of the field which received extra cultivation for weed control. Applying a light layer of straw or manure to such points will often prevent serious trouble. One load of straw will "tie down" a surprisingly large area .

Plowing Furrows. Single furrows plowed at one-rod intervals on focal points will often "tie down" these areas and prevent drifting from spreading over an entire field.

Listing. Lister shovels attached to a duckfoot cultivator at 4 or 5 foot intervals have been used successfully to control serious drifting on large areas.

Water Erosion

While wind erosion is most serious during dry seasons and water erosion more troublesome in seasons of above normal rainfall, the fundamental causes of both types of erosion are the same. Bare fields, in which the fibre has been destroyed through cultivation and cropping, provide ideal conditions for the development of both kinds of erosion.

In the development of a water erosion problem there are three main stages, namely, sheet erosion, rill erosion and gully erosion. Sheet erosion, the first stage, is the removal of successive thin layers of loose soil from the surface of the field. In one sense this is the most serious type because it gradually eats away the surface of the soil and, in its initial stages, easily escapes detection. The second stage, rill erosion, is identified by numerous tiny gullies or rills which appear in the surface soil, usually on the sloping parts of a field. The third stage is gully erosion. Here the surface soil is first washed away, and is soon followed by sub-soil erosion; the final result being the formation of deep gullies or ditches.

As everyone knows, water is both a friend and an enemy to the soil. The force of raindrops falling on bare soil breaks down the lumps and clods, and washes the resulting fine material into the open spaces in the surface soil. This forms a tight, impervious layer or crust on the soil surface. This crust is often referred to as the "shanty roof" because it retards or prevents water from entering the soil. If rain falls on the soil covered with a shanty roof, it cannot percolate into the soil, and therefore runs off. If a sufficient volume of water accumulates, it starts cutting into the soil and serious erosion may result.

A trash cover will greatly reduce the danger of water erosion. It acts in three ways to protect the soil. First, a considerable portion of the rain falling on a field protected by a trash cover strikes the trash instead of the soil surface. In this way the tendency to form a shanty roof is lessened. Second, the straw, stubble, etc., anchored in the surface soil, provides channels through which the rain can enter the soil. Third, if the rainfall is so heavy that all of the water cannot be absorbed, and some starts to run off, the trash slows down the rate of flow of the water and reduces its erosive action.

It has been clearly demonstrated that the use of a good trash cover is capable of preventing most of the soil loss, through water erosion, that occurs on a very large percentage of our prairie soils. It is also capable of reducing appreciably the loss of soil from sloping fields.

The following figures from an actual experiment carried out by the United States Soil Conservation Service, show the effectiveness of trash cover in saving moisture and preventing soil loss through water erosion.

Method of Cultivation	Moisture Stored (inches)	Soil Lost (tons per acre)
Trash Cover	3.78	.97
Bare Fallow	1.03	13.04

These results show that the loss of soil through erosion was less than one-twelfth as much on the trash-covered field as on the bare fallow. They also show that more than three times as much moisture was stored in the trash-covered field than in the bare fallow field. As moisture is the limiting factor in crop production in Western Canada almost every year, the importance and effectiveness of the trash cover in preserving moisture and reducing soil erosion cannot be over-emphasized.

Gullies

The formation of gullies in a field, as has been mentioned before, is the third stage in accelerated water erosion. Usually gullies form in the natural drainage channels. Previous to being cultivated these channels were protected by grass and other growth which prevented erosion. Consequently, the obvious and practical thing to do when gullying first starts is to restore a grass cover to the drainage channel, and thus prevent further erosion. Where a gully has formed it is, of course, necessary to fill it in before seeding it to grass.

In filling a gully, certain precautions are necessary to prevent a recurrence of the problem. First, the soil used to fill the gully should be firmly packed. If this is not done the settling of the loose soil may cause a break in the grass cover and allow erosion to begin once more. Second, the bottom of the newly formed channel should be flat and broad so as to spread out the water flow, thus reducing its erosive action. If erosion starts there is great danger of the water undermining the grassed portion of the channel and destroying the entire project. Third, the grass cover should extend well up on the sides of the newly formed drainage channel. This is to prevent the water from a heavy run-off rising above the grassed channel, and eroding the unprotected soil at higher levels.

Keeping Our Soils Productive

While a trash cover will do much to prevent wind and water erosion it alone will not return a sufficient quantity of fibre and organic matter to the soil. Consequently the use of a trash cover should be considered only as a minimum effort in erosion control.

The growing of grasses and legumes, in areas where moisture conditions are favorable to their growth, is recognized as being of prime importance in restoring fibre and fertility to the soil and thus maintaining its productivity. Many farmers, however, although aware of their soil losses are not in a position to seed down extensive areas to forage crops. To these in particular we would like to stress the importance of the "trash cover." It is an inexpensive and efficient means of preventing soil erosion and helping to keep our prairie soils productive.

FRONT COVER PICTURE—Courtesy Dominion Experimental Station, Lethbridge, Alta.

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